

# ► **Role of Natural Gas in Promoting Bioenergy as a Component of the Sustainable Energy Scenario**

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**Presented by:**

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**at**

**Natural Gas/Renewable Energy Hybrids Workshop**

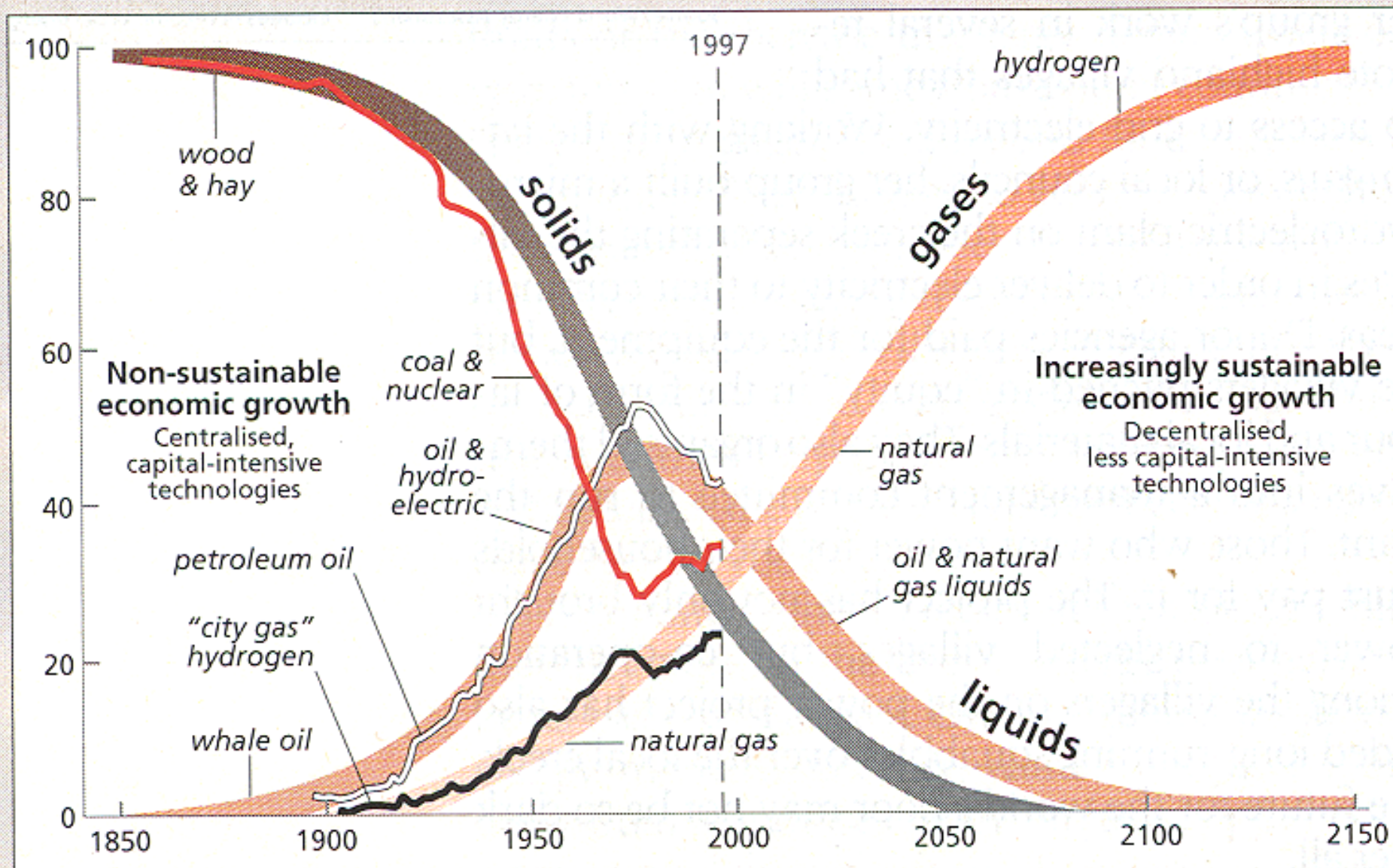
**NETL, Morgantown, WV**

**August 8, 2001**

# The shape of things to come?

Global energy systems transition, % of market

— actual solids consumption  
— actual gas consumption  
— actual liquids consumption



# Assumptions

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- **Sustainable Supply of Biomass Feedstock at \$1.50/million Btu or less is Available to Industries Which Currently use Natural Gas**
- **Biomass Gasification Processes of 10 to 1000+ Dry TPD (0.5 MWe to 50+ MWe) Capacity are Commercially Available**

# Background Data

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- **Annual Natural Gas Production : 19Q**
- **Annual Natural Gas Imports : 4Q**
- **Annual Industrial Natural Gas Use : 10Q**
- **Amount of Oil used for Chemicals and Industrial Building Blocks: 5Q**
- **Present Annual Biomass Consumption: 3Q**
- **Potential for Biomass Resources: 16Q/Year (at \$30/dry ton)**

# Major Industrial Gas Uses

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- Process Heat
  - Boilers
  - Co-generation
  - HVAC
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- *Biomass could be the largest source of renewable energy*
  - *Bioenergy (heat, fuelgas, or oil) could substitute for natural gas in most industrial applications*
  - 5Q/yr. of new Bioenergy could conserve >20% of natural gas or ~20% of oil used today

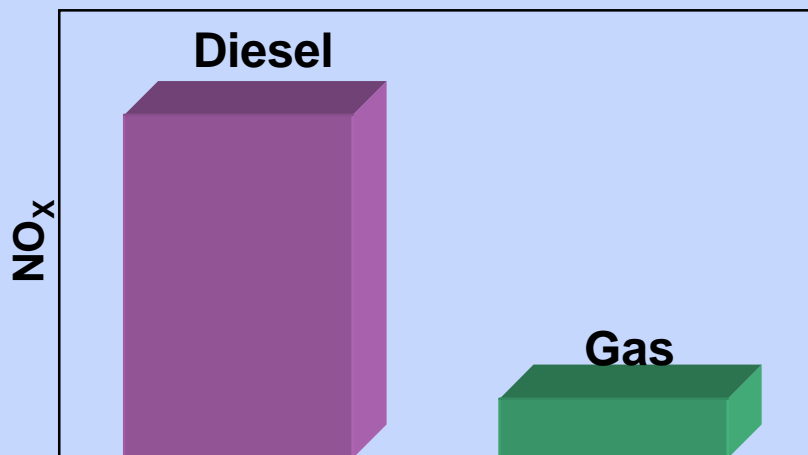
# Drivers for Distributed Generation

## ■ Infrastructure Growth

- Pipeline Growth Rate
- 5% Cum. Ann. Growth Rate Worldwide
- North America Growth to increase with the New Energy Policy

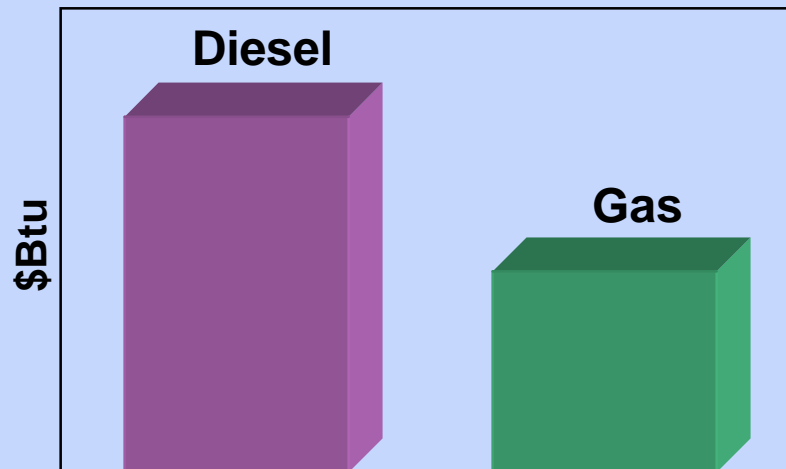
## ■ $\text{NO}_x$ Emissions Advantage

- 10-15% of Diesel Simple Cycle



## ■ Fuel Cost Advantage

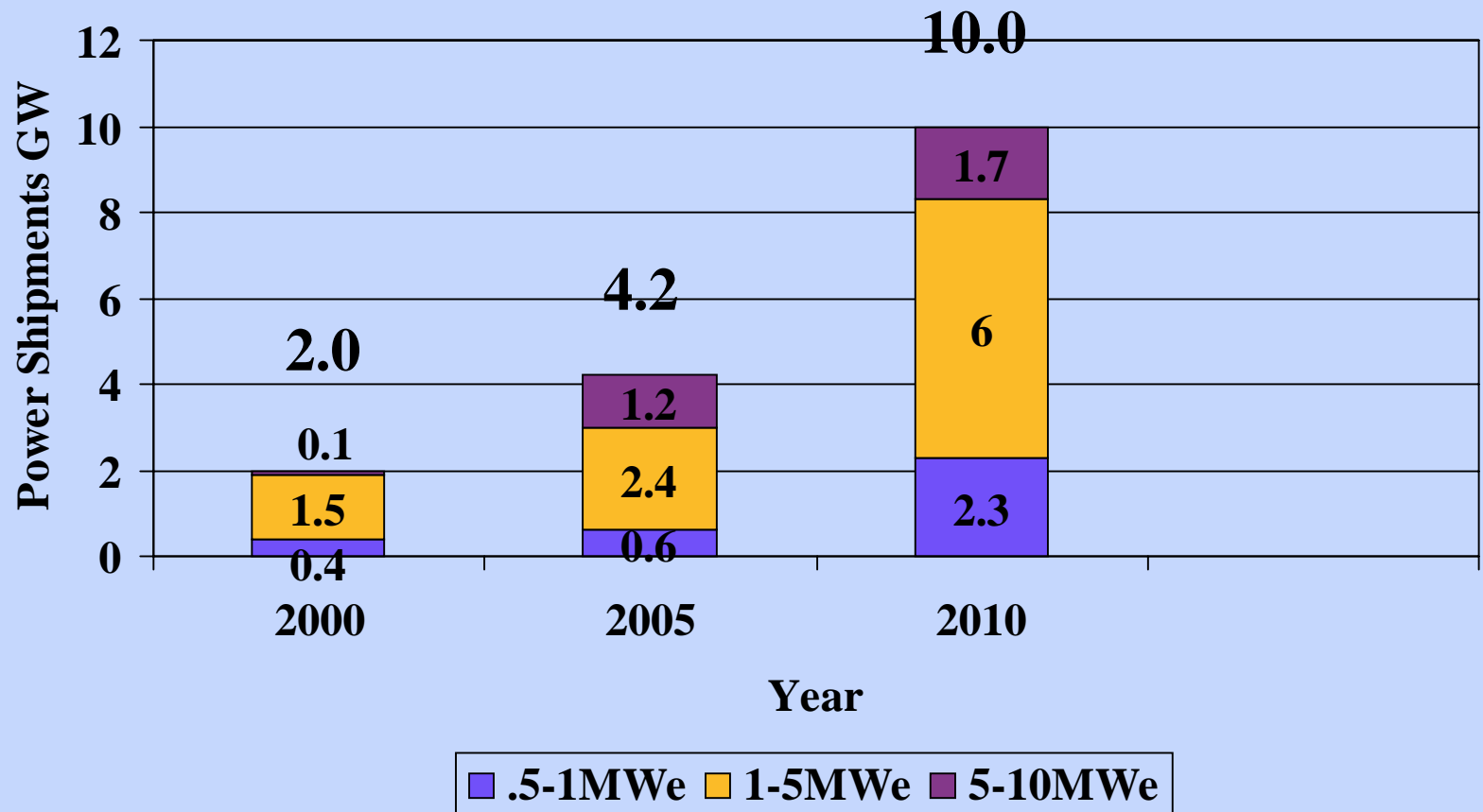
- 50% of Diesel



Source: CATERPILLAR

# Market Growth for Gas Engines in Distributed Power

*1Q/year of Dry Biomass = 10 GWe at 27% Electrical Efficiency*



# A Case for Co-utilization of Natural Gas and Biomass Fuel Gas

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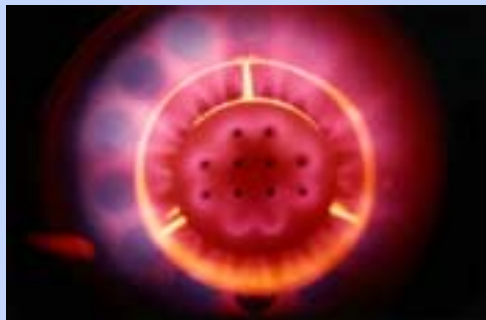
- **Natural Gas is a Valuable Chemical Feedstock**
- **Natural Gas Demand Will Increase With Increasing Industrial Growth**
- **LCV Gas From Biomass Could Replace Natural Gas in Many Applications**
- **Total Substitution Would Require Significant Equipment Modifications or Replacement With New Equipment**
- **Enriching Biomass Fuel Gas With Natural Gas May Circumvent the Problem**
- **Co-utilization of Natural Gas and Biomass Derived Fuel Gas –**
- **Should Expedite Commercialization of Bioenergy**
- **Provides Bioenergy Diverse Market Entry Options**
- **Builds-up Production Volume and Provides Resources for Product Optimization**



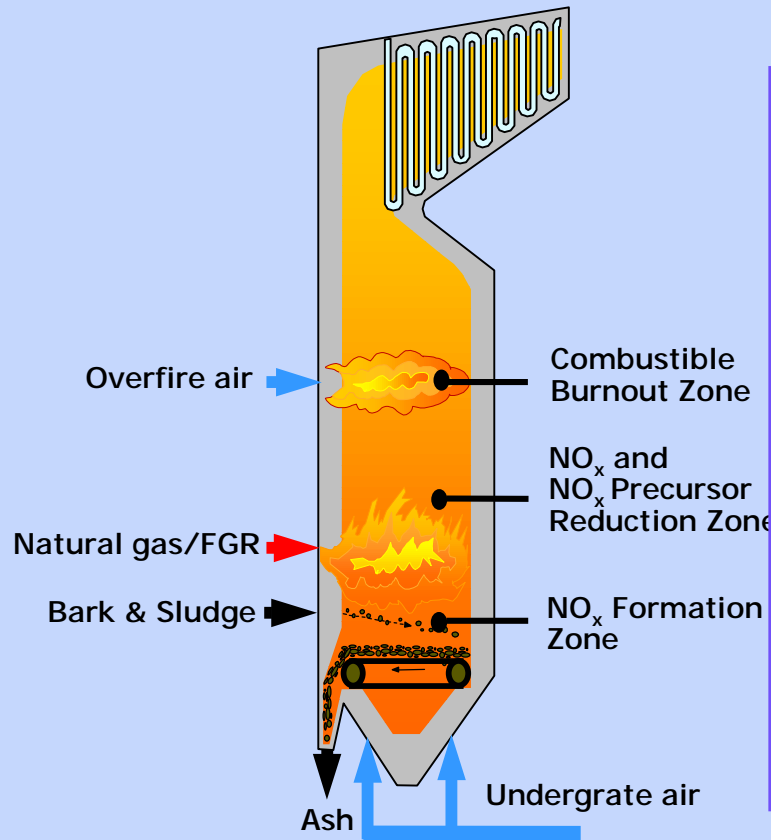
# Other Co-utilization Applications

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- **Co-firing Natural Gas and Biomass in (Stoker) Boilers**
- **Biomass Gasification Followed by Co-firing of Fuel Gas and Natural Gas in Energy Conversion Devices (Burners, Engines, and Gas Turbines)**
- **Pyrolysis of Biomass Followed by Co-firing Liquid Fuels and Natural Gas - (Burners, Engines, and Turbine Engines)**



# GTI METHANE de-NOX<sup>®</sup> Reburning Process for Stoker Boilers



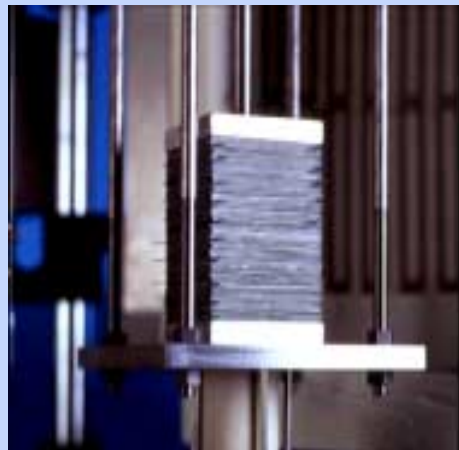
A reburn technology using 5% to 25% natural gas heat input for combustion improvement and 50-70% NO<sub>x</sub> reduction in coal-, biomass-, and MSW-fired stoker boilers



# Potential Candidates for Bioenergy Uses

- LCV gas and MCV gas - heat, power, reducing gaseous medium for mineral processing, and fuel cell power
- Synthesis gas - chemicals, liquid fuels, fuel additives, fertilizers, substitute natural gas, and hydrogen
- Pyrolysis liquids/Bioconversion Liquids - ???

**SOFC**



**Pyr. Liquid**



# USDOE EE-RE Biopower Program is Focused on Challenges/Opportunities for Biomass Gasification

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## PROGRAM FOCUS

- Low-cost Reliable Gasification Systems
- Raw Gas Clean-up to Current Fuel Gas Specifications
- Gas Utilization
- Infrastructure/Policy/Education & Outreach

## CLOSING

- *Investments made during the first-half of 20<sup>th</sup> Century to develop and utilize fossil fuels led to economic prosperity during the latter half of 20<sup>th</sup> Century*
- *Investments made now for renewables, biomass in particular, will lead to environmental, energy, and economic prosperity in the future*